APRIL 1976
No. 4

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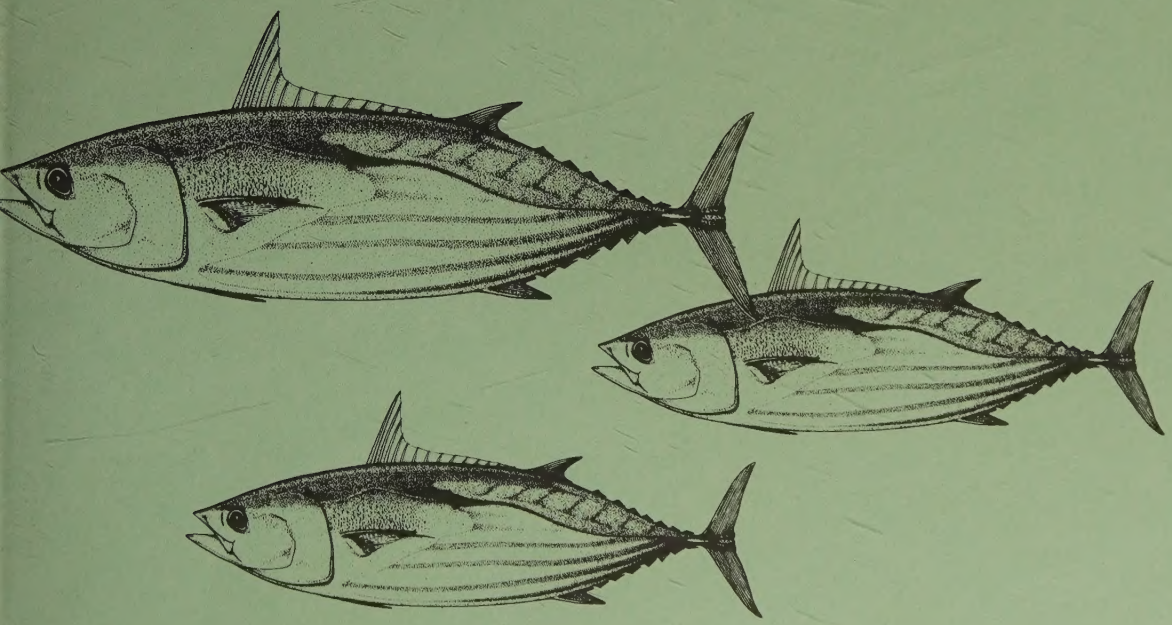

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
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FISHING INFORMATION

APRIL 1976 , No. 4

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PREFACE

This publication, Fishing Information, appears monthly and contains 1) fishery advisory information, 2) a narrative description of pertinent surface temperature conditions, 3) charts of winds and pressures for the eastern North Pacific, 4) charts of sea surface temperature for the North Pacific and eastern tropical Pacific, and 5) charts of subsurface temperature structure in the eastern North Pacific.

A supplement to Fishing Information appears at 15-day intervals throughout the year. This is a chart of sea surface temperature (contoured at 2°F (1°C) intervals) from Baja California to Vancouver Island out to about 135°W. Special bulletins are published in conjunction with the 15-day sea surface temperature charts which include short-term projections of albacore distribution and locations of productive fishing areas, information on oceanographic and atmospheric conditions, and other information as is appropriate during the albacore fishing season.

The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this publication approved by the Office of Management and Budget, August 20, 1973; this approval expires June 1976.

Submitted for publication - June 2, 1976

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ENVIRONMENTAL CHARTS ANALYZED BY:

F. Miller (Figures 8 and 9
J. Renner (Figures 1, 2, 3, 4, 5, 6, 7, 10, 11, 12, 13 and 15-day Supplement)

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Expendable bathythermograph and salinity observations are made by the mates and engineers of the *California, Hawaiian Enterprise* and *Hawaiian Queen* of Matson Navigation Co. The data are processed under supervision of D.R. McLain at the NMFS Pacific Environmental Group, Monterey, using computer facilities of the Fleet Numerical Weather Center. The project is partially supported by the National Science Foundation and the Office of Naval Research.

Sea Surface Temperature and Environmental Conditions

N. CLARK AND F. MILLER

Eastern North Pacific

Seasonal warming began at a below-normal rate over most of the eastern North Pacific during April 1976, and sea surface temperatures increased only slightly (≤1.0°F or ≤0.6°C) from March yearly minimum values. An exception to this warming occurred between Baja California and Hawaii where temperatures dropped 0.5 to 1°F (0.3 to 0.6°C).

The sea surface temperature anomaly pattern for April is similar to that of March. However, the large area of 1 to 3°F (0.6 to 1.7°C) above-normal temperatures in the central portion of the eastern North Pacific decreased in size and intensity, while below-normal temperatures over most of the Gulf of Alaska and off the North American west coast dropped to 2 to 3°F (1.1 to 1.7°C) below-normal values. The cooling trend that occurred between Baja California and Hawaii caused temperatures that were 1 to 2°F (0.6 to 1.1°C) below-normal to decrease to 2 to 3°F (1.1 to 1.7°C) below-normal values.

A high pressure cell with sea level pressure up to 4 millibars above normal extended over most of the eastern North Pacific south of 40°N during April. Sea level pressures were up to 6 millibars below normal over the Aleutian Islands and the Gulf of Alaska. Strong north-south pressure gradients between these two anomaly centers caused stronger-than-normal westerly to north westerly winds between 40°N and 55°N which contributed to the below-normal heating in this area.

Western North Pacific

The greatest change in the western North Pacific sea surface temperature anomaly pattern during April occurred between 25°N and 35°N and 150°E and 165°E where two regions of contrasting 1 to 3°F (0.6 to 1.7°C) positive and negative temperature anomalies formed next to each other causing strong horizontal sea surface temperature gradients. An area of 2 to 4°F (1.1 to 2.2°C) below-normal temperatures formed southeast of Hokkaido and east of northern Honshu replacing above-normal temperatures that existed in March. The anomaly pattern in the central portion of the western North Pacific is similar to that of the previous month with many small regions of 1 to 2°F (0.6 to 1.1°C) above and below-normal temperature anomalies.

Eastern Tropical Pacific

Seasonal sea surface temperature (SST) changes are small from March to April north of the equator except in the area from 7°N to 12°N and east of 110°W. Here SST's usually increase 2°F (1.1°C) or less as a result of nearly clear skies and light winds accompanied by strong solar heating in the surface layer of the ocean. Along the equator from 5°N to 5°S SST's normally begin to cool as much as 2°F (1.1°C) east of 110°W; to the west they warm slightly in April. In the southern hemisphere from 5°S to 30°S the seasonal cooling is normally less than 1°F (0.6°C) except in the Peru Current. From March to April of each year SST's normally decrease as much as 3°F (1.7°C) in the Peru Current. Near the equator and east of 90°W, where the Peru Current turns westward, the oceanic frontal boundary begins to show up again at the surface after an absence of 3 months.

During April 1976 SST's over the fishing grounds from 25°N to the equator (Figure 8) were similar to those in April 1975. Along the southwest coast of Baja California SST's were near normal with only a narrow band of cooling offshore south of 25°N (Figure 9). In two areas centered around 10°N between 90°W and 110°W and between 120°W and 160°W the SST's were at least 2°F (1.1°C) below normal (Figure 9) in April 1976. In both areas above normal northeast trade winds and cloud cover persisted most of the month. This led to more vertical mixing and less heating in the surface layers of the ocean than would normally occur during this season. Near the equator from 5°N to about 2°S oceanographic conditions were opposite of those to the north. In the equatorial zone, especially east of 120°W, upwelling along the equator was diminished and surface water was warmed by solar heating in very light wind conditions. As a result, areas of positive SST anomalies (Figure 9) expanded since March 1976. A nearly identifical pattern of events occurred in April 1975. The available data from merchant ships and the NOAA-3 and -4 satellites indicate that the areas of largest positive SST anomalies have remained 100 miles or more off the coast of Ecuador for the past 2 or 3 months. Along the coast of Peru and Ecuador the SST's have been near or slightly below normal (Figure 9) during the southern summer. There are good indications from the data that south of 10°S along the coast of Peru, upwelling in the Peru Current has maintained below normal SST's in April 1976. This condition was verified by the fact that the southern hemisphere surface high pressure system remained strong with above normal southeast trades along the coasts of Chile and southern Peru during the entire month.

EARLY APRIL OBSERVATIONS OF THE NORTHEAST PACIFIC TRANSITION ZONE PRIOR TO THE 1976 ALBACORE FISHING SEASON

J. F. T. SAUR*

The purpose of this note is to describe certain early April 1976 oceanic conditions in the northeast Pacific Ocean with relation to the character of the transition zone, which lies between the California Current and eastern North Pacific central waters. In previous years certain oceanic features have persisted into mid-summer and often throughout the summer into October-November. Thus they tend to indicate oceanic conditions to be expected during the albacore fishing season.

For this analysis a special attempt was made to obtain nearly synoptic sections of expendable bathythermograph (XBT) observations and surface salinity observations during early April between Honolulu and four U.S. west coast ports: Seattle, San Francisco, Los Angeles and San Diego. Sections by three merchant ships were coordinated with the schedule of the research vessel Townsend Cromwell which was returning from San Diego to Honolulu at that time. Fortunately this nearly coincided with the end of the winter cooling period. The three southern sections were made concurrently and the Seattle section was made in the second week of April. The observations from these four sections are presented in the usual format in Figures 10-13.

This discussion will focus mainly on two oceanic features: the temperature at 100 meters and surface salinity fronts. The horizontal distribution of these are shown in Plate 1, below.

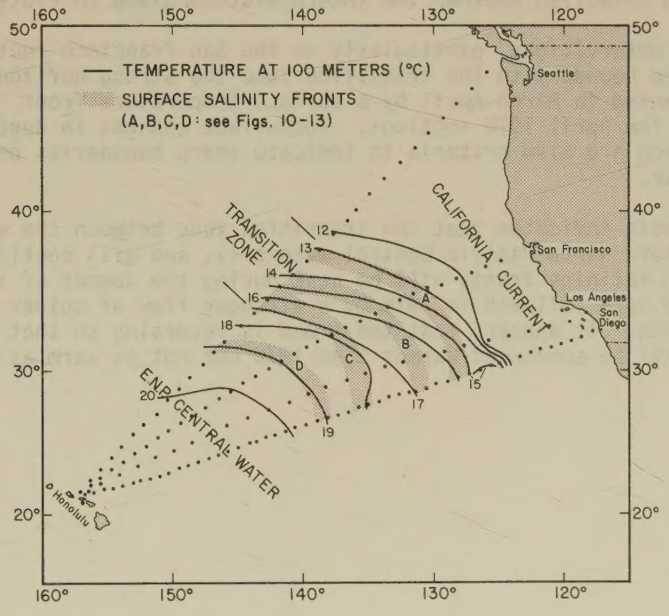


Plate 1. Temperatures (°C) at 100 meters and surface salinity fronts in the region of the transition zone of the Northeast Pacific Ocean, early April 1976.

*Scripps Institution of Oceanography, La Jolla, CA

Over most of the northeast Pacific Ocean north of 25°N the seasonal cooling cycle at the surface generally ends in March. With continued mixing by winds the surface mixed layers reach their maximum depth in late March or early April. This year except near the west coast in the California Current mixed layers on all four XBT sections, Figures 10-13, are generally at least 100 m. They are deepest in the central part of each section, on the Seattle route where there is a large winter heat loss from the sea surface and on the San Diego route in the trade wind regions. In these regions the mixed layers reach to depths of 150 m and more.

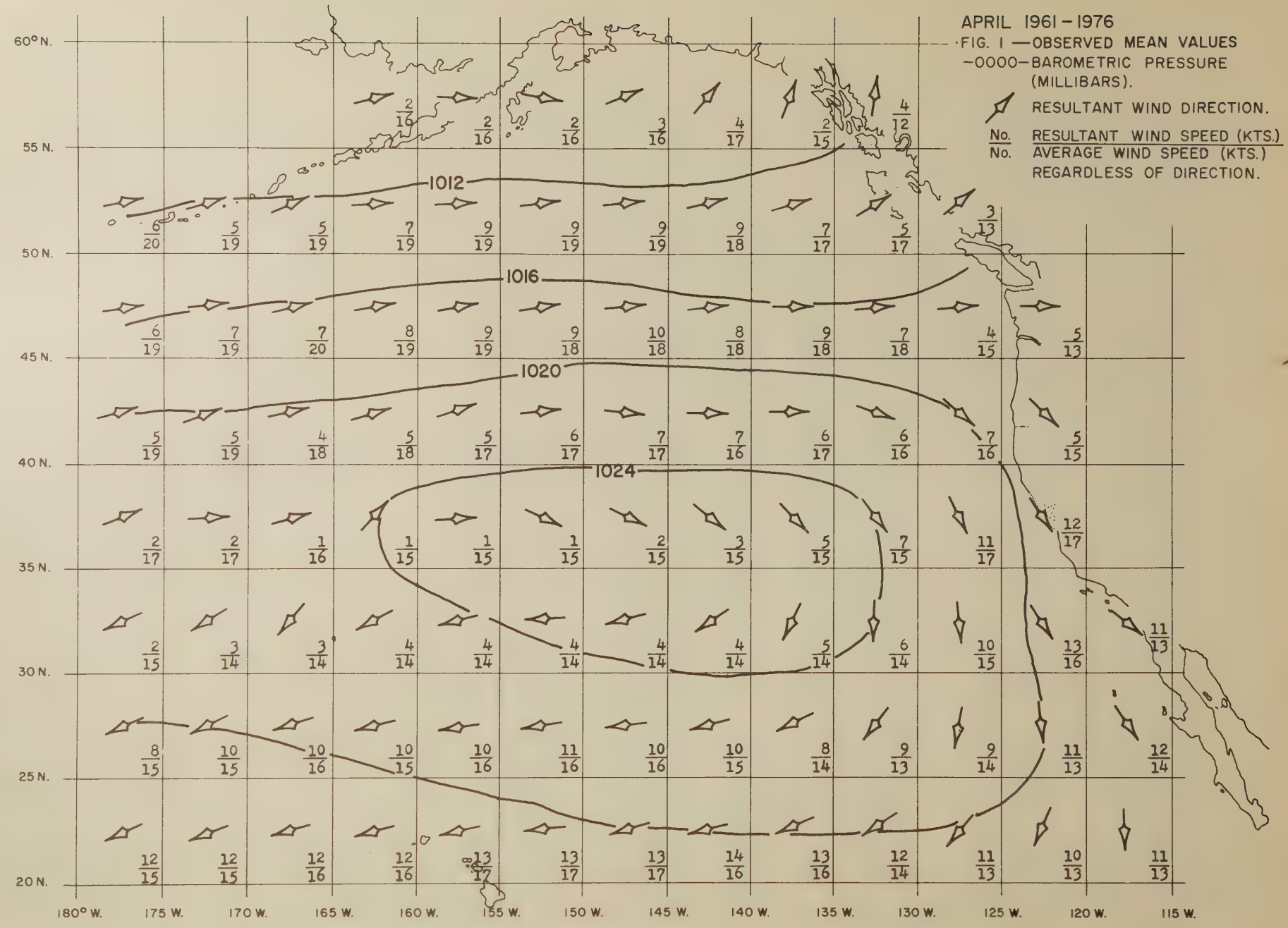
Since most of the seasonal heating in summer and fall is confined to the upper 50-75 m, the temperature isotherms at 100 m remain in about the same location until late fall. The April 1976 positions for 12 - 20°C isotherms, whose range spans the transition zone, are shown in Plate 1. Except for a region about 300 nautical miles (550 km) west of San Diego there are no strong horizontal gradients in 100 m temperatures or changes in depth of the thermocline to indicate sharp boundaries of the transition zone.

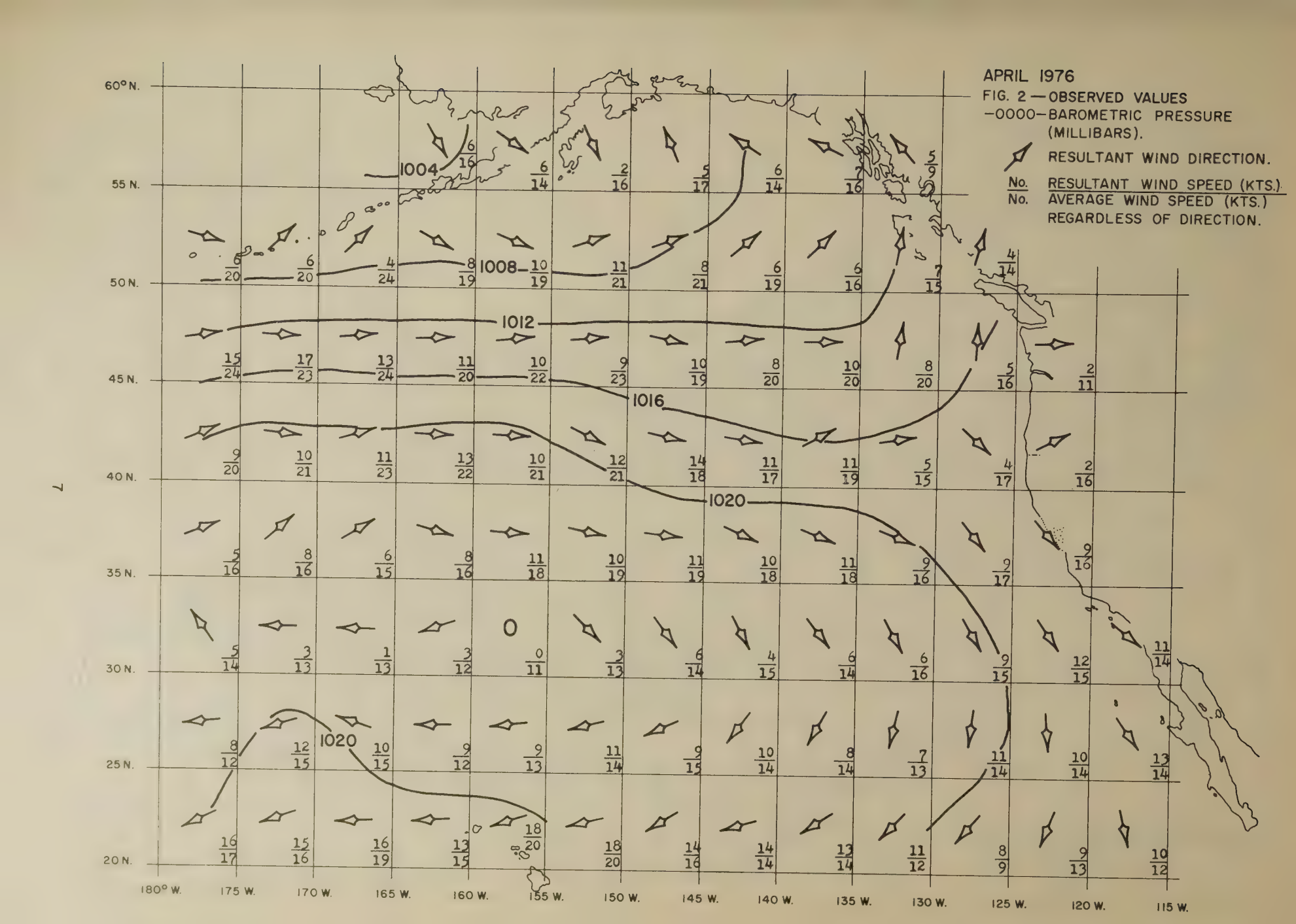
Surface salinity fronts also help to locate the transition zone. In early April there were four weak fronts in each section. These have been labeled A, B, C, and D on the horizontal surface salinity profiles in each of Figures 10-13. Assuming that these fronts are continuous between sections results in an orientation of frontal regions as shown by the shading in Plate 1. The reader is cautioned that the representation of fronts in Plate 1 is a smoothed, or schematic one. In detail, fronts will usually be narrower than the spacing between the XBT observations. On the other hand they may meander considerably in both space and time.

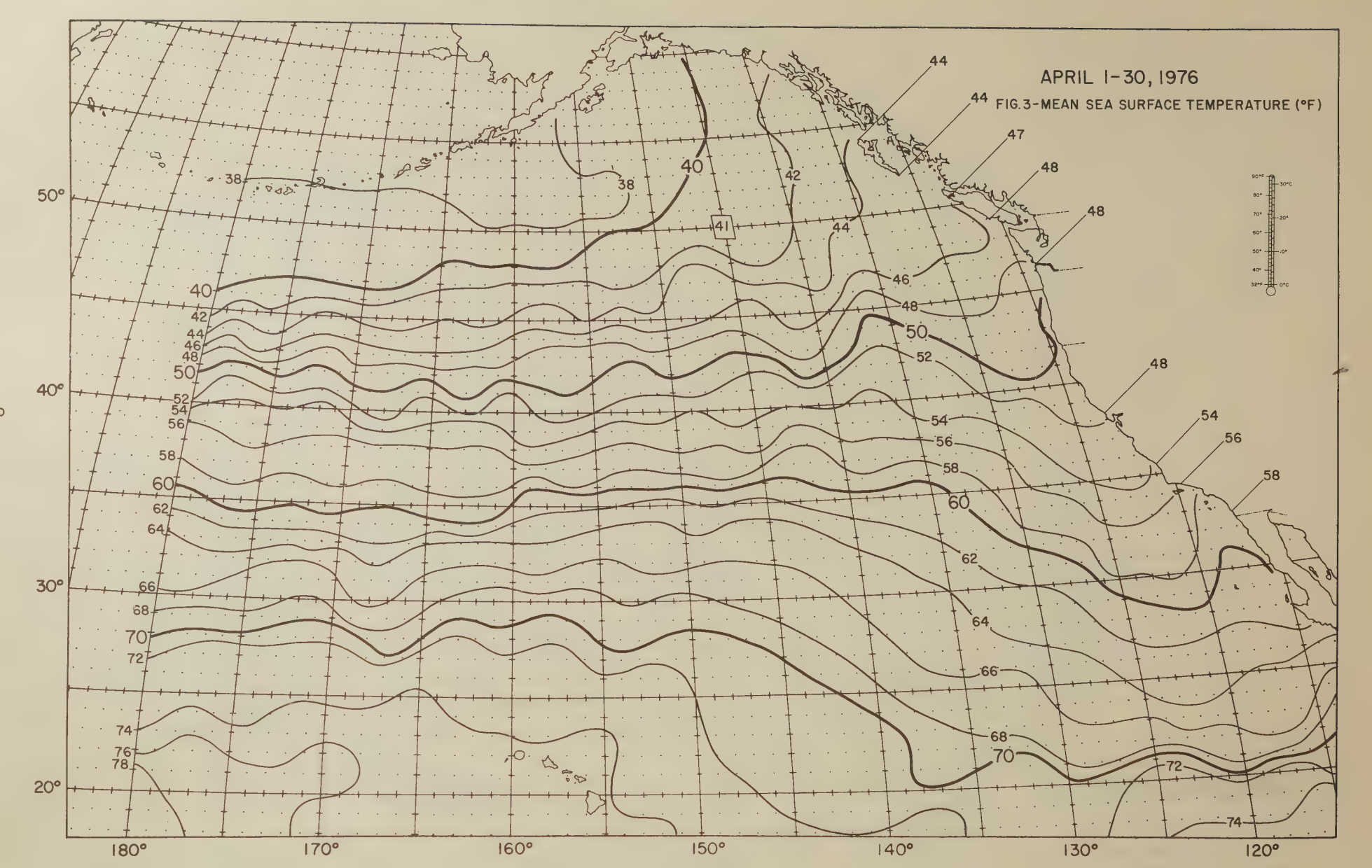
The nearly north-south orientation between the San Francisco route and the two southern routes is a departure from previous concepts that the fronts continue in a NW to SE direction toward Baja California. It is hoped that the albacore scouting cruise of David Starr Jordan in June will be able to establish whether the interpretation given in Plate 1 is valid or not.

Our historical observations, particularly on the San Francisco route, have indicated that when there is a sharp boundary to the transition zone the strong horizontal salinity gradient, or front, is accompanied in March-April by a surface temperature front. No consistent pattern of this type occurs in the April 1976 sections. Subsurface changes in depths of isotherms in the 100-200 m layer, which are also criteria to indicate sharp boundaries between water masses, are also absent this year.

The above analysis indicates that the transition zone between the waters of the California Current and the Eastern North Pacific Central waters is, and will continue to be, diffuse and that temperature and salinity fronts will be weak during the summer of 1976. Such conditions occurred in 1974 and were followed in 1975 by a stronger flow of colder lower salinity water in the California Current. It appears that the trend is reversing so that California Current waters in summer of 1976 will be somehwhat warmer than 1975 but not as warm as 1974.

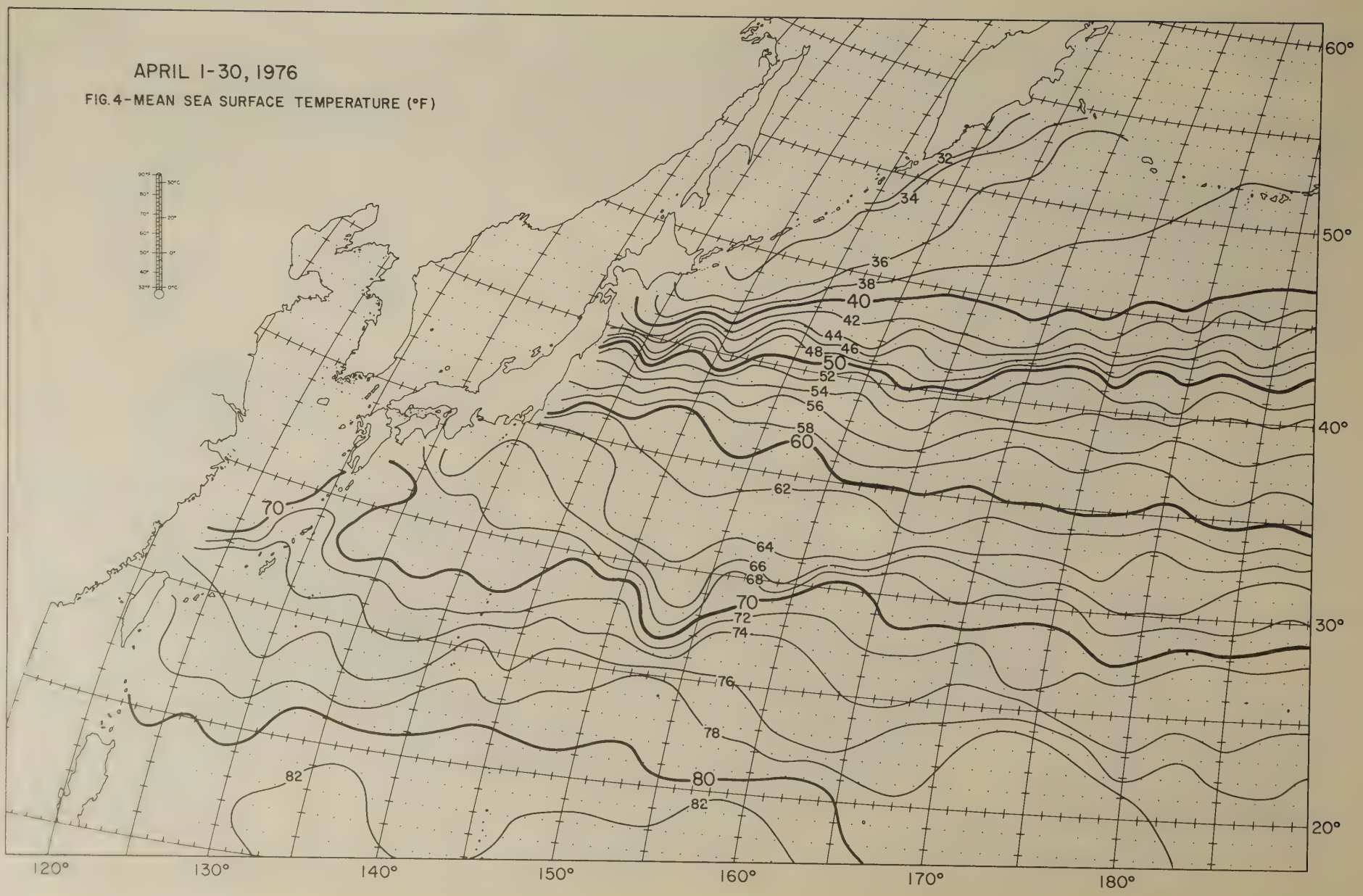

APRIL 1961 – 1976
FIG. 1 — OBSERVED MEAN VALUES
–0000– BAROMETRIC PRESSURE (MILLIBARS).
RESULTANT WIND DIRECTION.
No. RESULTANT WIND SPEED (KTS.)
No. AVERAGE WIND SPEED (KTS.) REGARDLESS OF DIRECTION.
1012
1016
1020
1024
60° N.
55 N.
50 N.
45 N.
40 N.
35 N.
30 N.
25 N.
20 N.
180° W.
175 W.
170 W.
165 W.
160 W.
155 W.
150 W.
145 W.
140 W.
135 W.
130 W.
125 W.
120 W.
115 W.

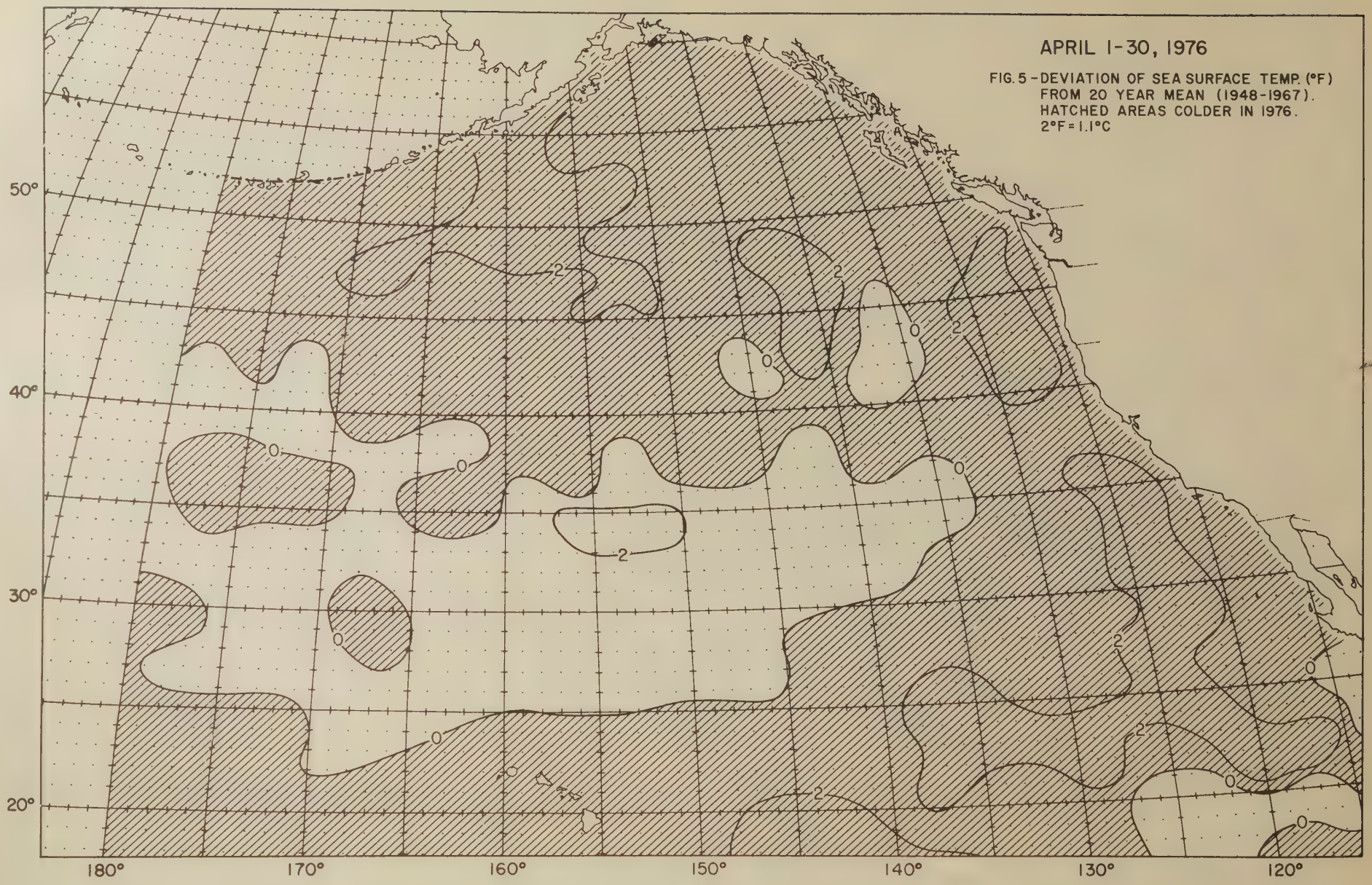

APRIL 1976
FIG. 2 — OBSERVED VALUES
—0000— BAROMETRIC PRESSURE (MILLIBARS).
RESULTANT WIND DIRECTION.
No. / No. RESULTANT WIND SPEED (KTS.) / AVERAGE WIND SPEED (KTS.) REGARDLESS OF DIRECTION.
1004
1008
1012
1016
1020
1020
60° N.
55 N.
50 N.
45 N.
40 N.
35 N.
30 N.
25 N.
20 N.
180° W.
175 W.
170 W.
165 W.
160 W.
155 W.
150 W.
145 W.
140 W.
135 W.
130 W.
125 W.
120 W.
115 W.

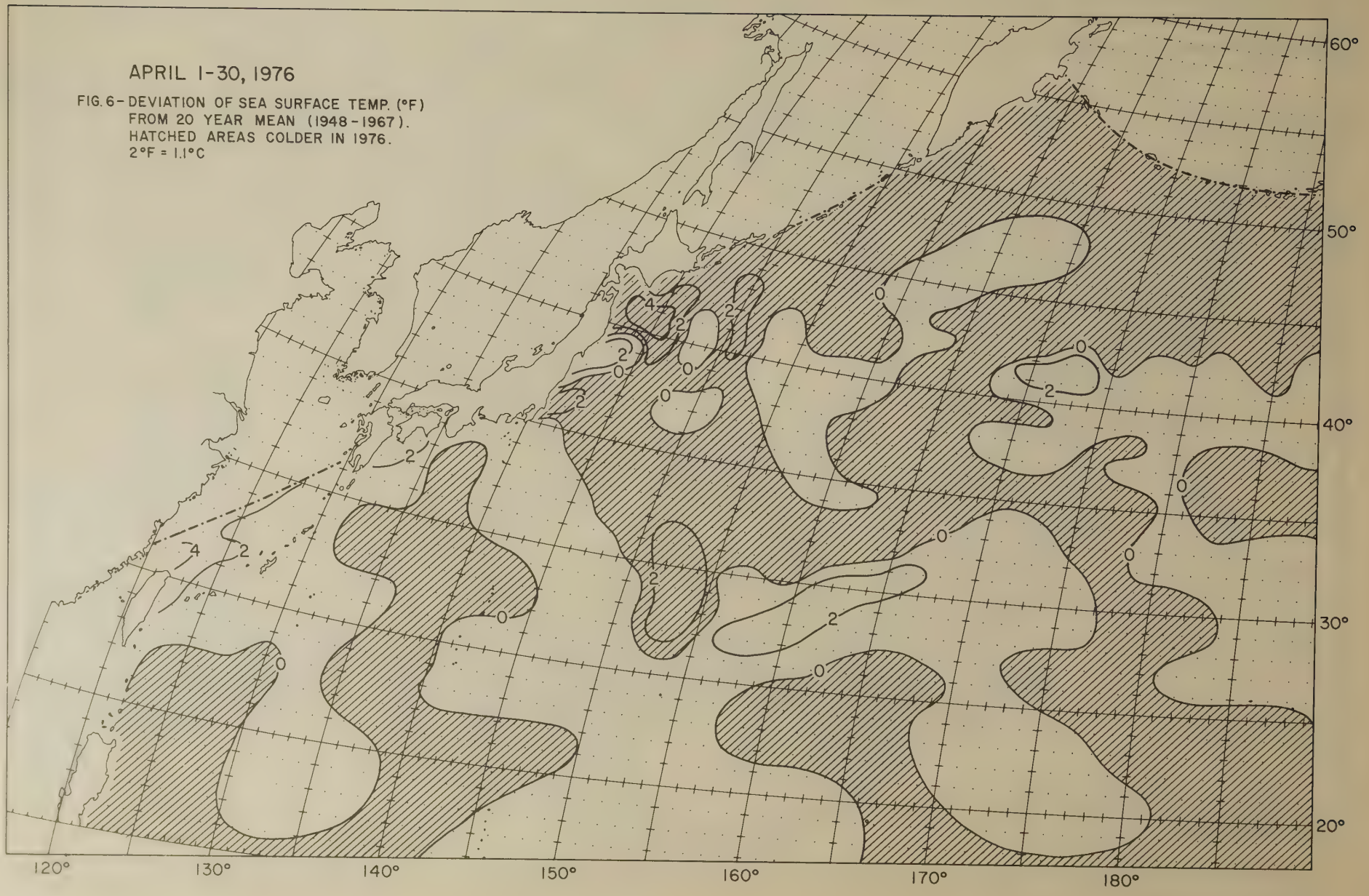

APRIL 1-30, 1976
FIG.3-MEAN SEA SURFACE TEMPERATURE (°F)
50°
40°
30°
20°
180°
170°
160°
150°
140°
130°
120°
38
40
41
42
44
46
47
48
50
52
54
56
58
60
62
64
66
68
70
72
74
76
78

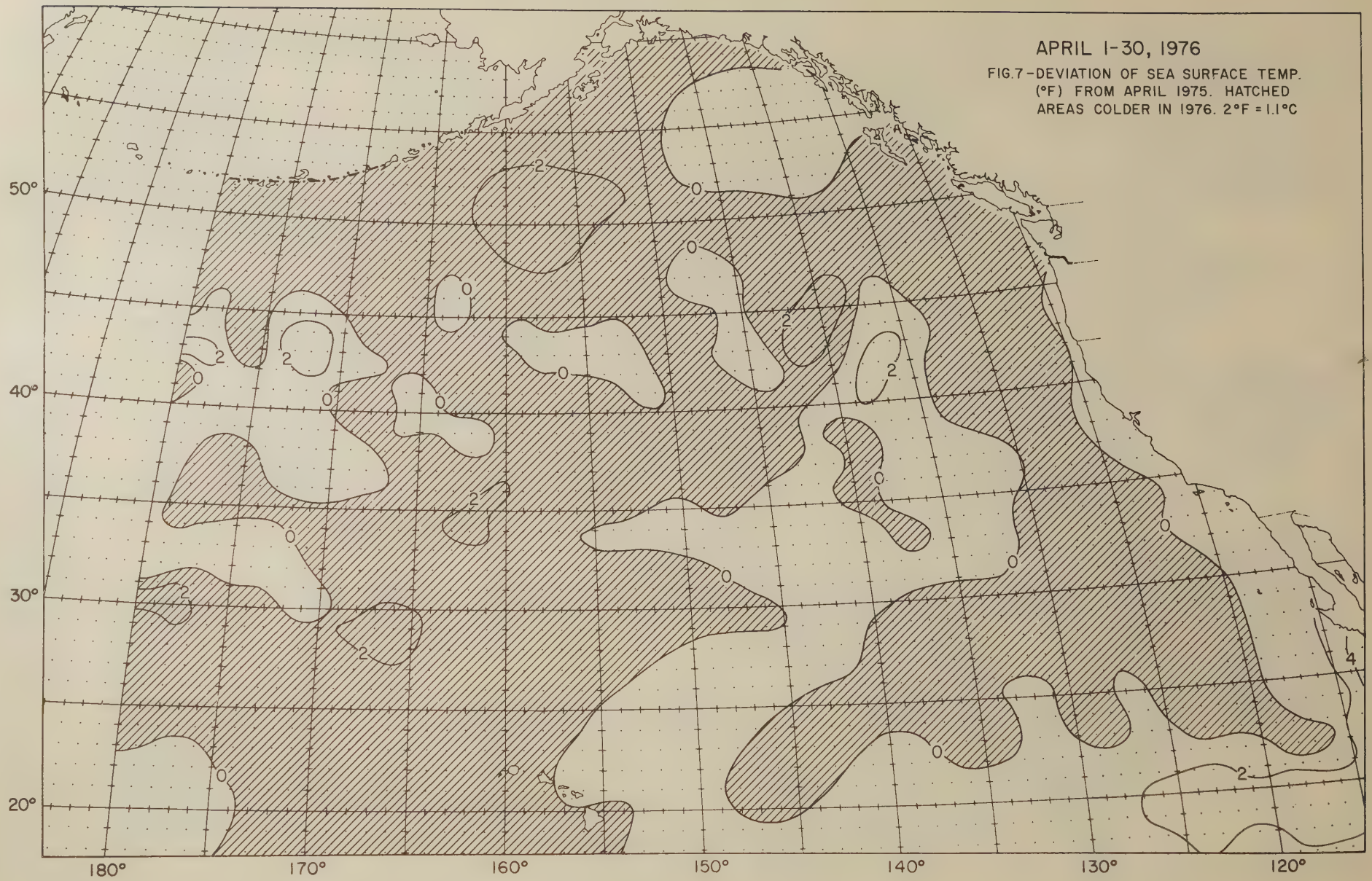
APRIL 1-30, 1976

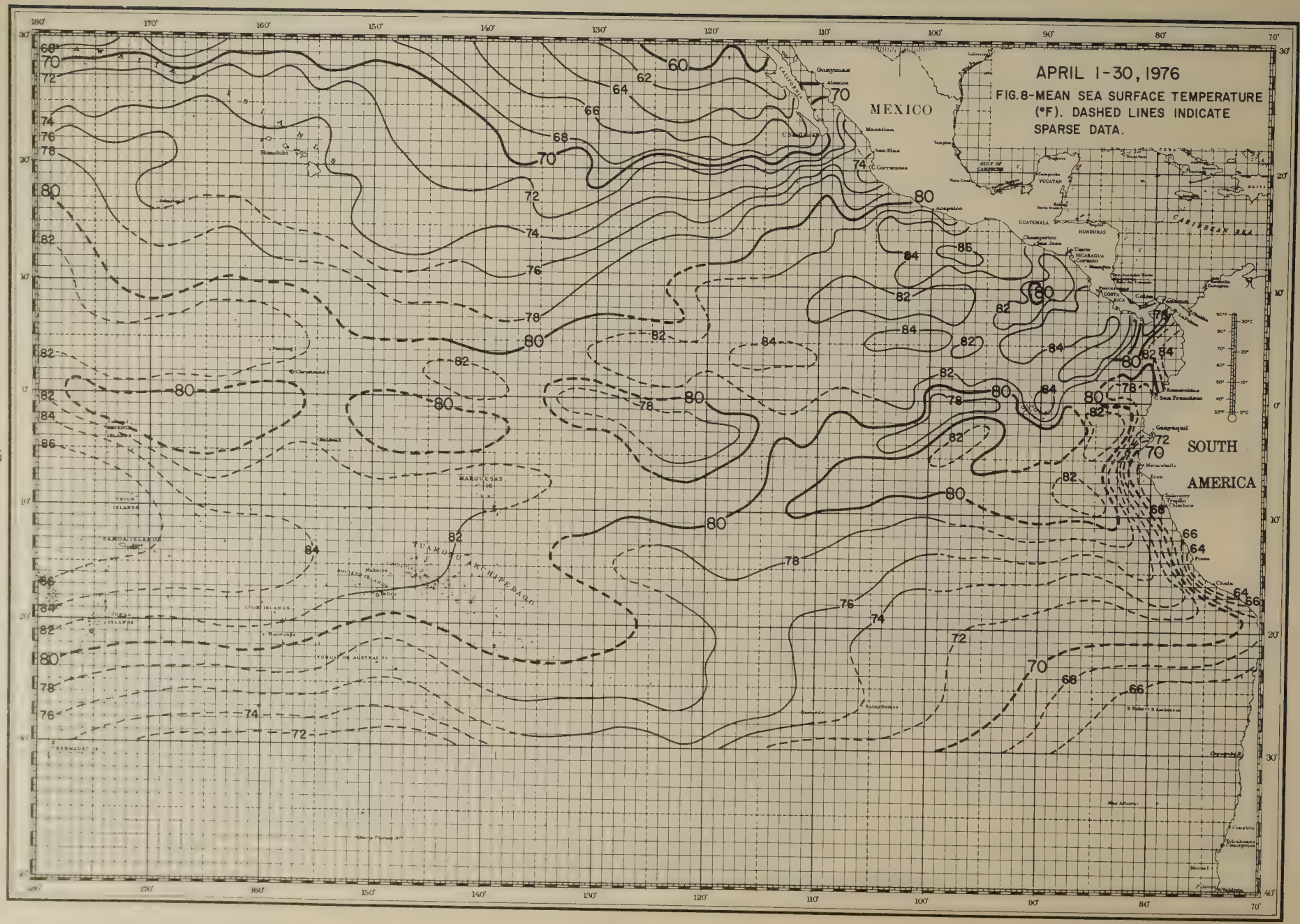
FIG. 4-MEAN SEA SURFACE TEMPERATURE (°F)




APRIL 1-30, 1976
FIG. 5 - DEVIATION OF SEA SURFACE TEMP. (°F) FROM 20 YEAR MEAN (1948-1967). HATCHED AREAS COLDER IN 1976. 2°F = 1.1°C
50°
40°
30°
20°
180°
170°
160°
150°
140°
130°
120°
2
0
-2


APRIL 1-30, 1976
FIG. 6 - DEVIATION OF SEA SURFACE TEMP. (°F) FROM 20 YEAR MEAN (1948-1967). HATCHED AREAS COLDER IN 1976. 2°F = 1.1°C
60°
50°
40°
30°
20°
120°
130°
140°
150°
160°
170°
180°


APRIL 1-30, 1976
FIG.7-DEVIATION OF SEA SURFACE TEMP. (°F) FROM APRIL 1975. HATCHED AREAS COLDER IN 1976. 2°F = 1.1°C
50°
40°
30°
20°
180°
170°
160°
150°
140°
130°
120°
0
2
4


APRIL 1-30, 1976
FIG. 8-MEAN SEA SURFACE TEMPERATURE (°F). DASHED LINES INDICATE SPARSE DATA.
MEXICO
SOUTH AMERICA
CARIBBEAN SEA
GUATEMALA
HONDURAS
NICARAGUA
COSTA RICA
MARQUESAS
TUAMOTU ARCHIPELAGO
COOK ISLANDS
SAMOA ISLANDS
TONGA ISLANDS
SOCIETY ISLANDS
Honolulu
Acapulco
Guaymas
Manzanillo
San Blas
Corrientes
Puntarenas
Callao
Guayaquil
Trujillo
Chimbote
Salaverry
Paita
Chala
Tumaco
San Francisco
Buenaventura
Colon
Cristobal
Panama
Galapagos Is.
Easter Is.
Pitcairn Is.
Bermuda
Nassau
Miami
Key West
Havana
Tampico
Vera Cruz
Progreso
Campeche
YUCATAN
GULF OF CAMPECHE
CUBA
HAITI
Galveston
New Orleans
Mobile
Charleston
Norfolk
Cape Hatteras
Cape Fear
Cape Lookout
Cape Henry
Delaware Bay
Chesapeake Bay
Block Island
Cape Cod
Nantucket
Boston
Portland
Halifax
Sydney
Yarmouth
Cape Race
St. John's
Cape Sable
Cape Canso
Cape Breton
Prince Edward Is.
Anticosti Is.
Gaspe
Quebec
Montreal
Ottawa
Toronto
Kingston
Detroit
Chicago
Milwaukee
Duluth
Port Arthur
Winnipeg
Lake Superior
Lake Michigan
Lake Huron
Lake Erie
Lake Ontario
Lake Winnipeg
Lake Manitoba
Lake of the Woods
Hudson Bay
James Bay
Baffin Bay
Davis Strait
Labrador Sea
Greenland
Iceland
Ireland
Scotland
England
Norway
Sweden
Finland
Denmark
Germany
Netherlands
Belgium
France
Spain
Portugal
Gibraltar
Azores
Madeira
Canary Is.
Cape Verde Is.
Dakar
Monrovia
Freetown
Conakry
Bissau
Bathurst
Casablanca
Tangier
Algiers
Tunis
Malta
Sicily
Sardinia
Corsica
Italy
Greece
Crete
Cyprus
Turkey
Black Sea
Sea of Marmara
Aegean Sea
Ionian Sea
Adriatic Sea
Tyrrhenian Sea
Mediterranean Sea
Alexandria
Port Said
Suez
Red Sea
Aden
Gulf of Aden
Arabian Sea
Persian Gulf
Muscat
Socotra
Mauritius
Reunion
Madagascar
Durban
Cape Town
Port Elizabeth
East London
Walvis Bay
Luanda
Lobito
Matadi
Boma
Pointe Noire
Libreville
Port Gentil
Douala
Victoria
Lagos
Port Harcourt
Calabar
Fernando Po
Abidjan
Takoradi
Accra
Tema
Cotonou
Lome
Abidjan
Sekondi

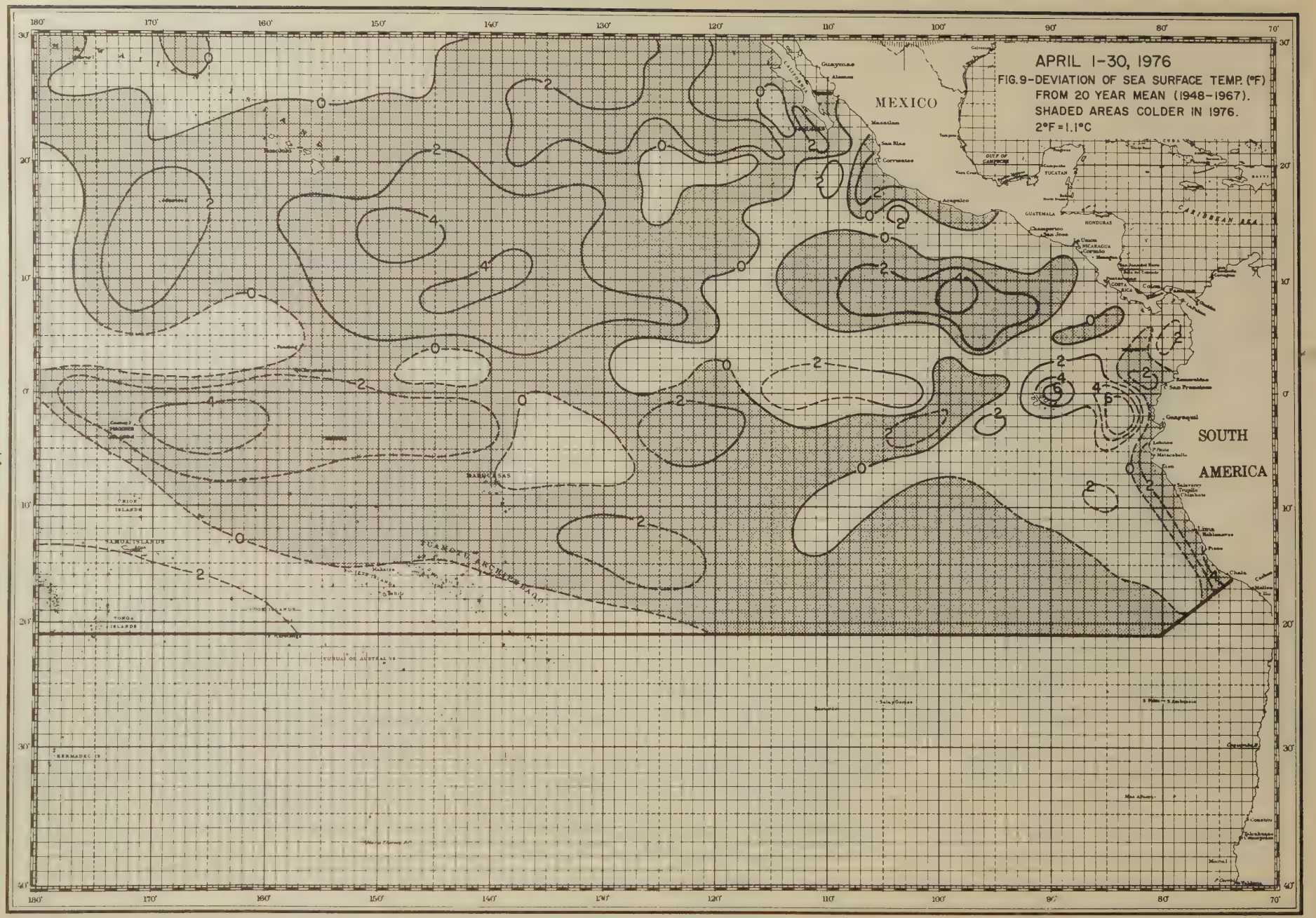
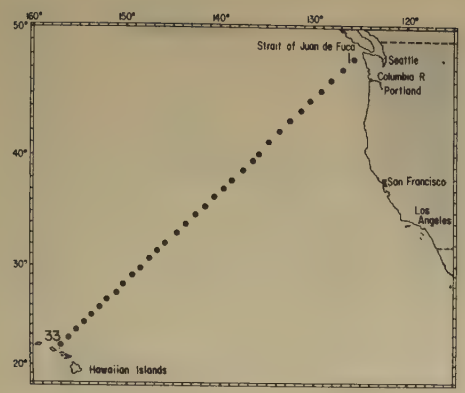
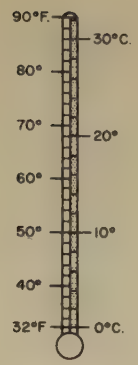

APRIL 1-30, 1976
FIG. 9-DEVIATION OF SEA SURFACE TEMP. (°F) FROM 20 YEAR MEAN (1948-1967). SHADED AREAS COLDER IN 1976.
2°F = 1.1°C
MEXICO
SOUTH AMERICA
CARIBBEAN AREA
GUATEMALA
HONDURAS
NICARAGUA
COSTA RICA
CUBA
HAITI
Guaymas
Mazatlan
San Blas
Acapulco
Guayaquil
Salaverry
Trujillo
Chimbote
Lima
Callao
Pisco
Chala
Matarani
Mollendo
San Francisco
Tumbes
Salinas
Manta
Esmeraldas
Colon
Puntarenas
Corinto
Champerico
San Jose
Cormito
Managua
Tampico
Veracruz
Yucatan
Campeche
Progreso
Belize
Havana
Kingston
Haiti
Galapagos Is.
Cocos Is.
Malpelo I.
Gorgona I.
Gallo Pt.
Tumaco
Buenaventura
Malaspina
Pitcairn Is.
Tahiti
Samoa Islands
Tonga Islands
Cook Islands
Tuamotu Archipelago
Easter Island
Tubuai or Austral Is.
Hermadec Is.
Salas y Gomez
Juan Fernandez Is.
Mas Afuera
Mas a Tierra
Coquimbo
Constitucion
Talcahuano
Concepcion
Valparaiso
Juan Fernandez Ridge
Marquesas Is.
Nukuhiva
Fanning I.
Christmas I.
Line Islands
Phoenix Is.
Canton I.
Enderbury I.
Baker I.
Howland I.
Jarvis I.
Palmyra I.
Johnston I.
Hawaiian Is.
Honolulu
Midway Is.
Wake I.
Marcus I.
Bonin Is.
Volcano Is.
Guam
Caroline Is.
Marshall Is.
Gilbert Is.
Ellice Is.
Fiji Is.
Suva
New Caledonia
Loyalty Is.
New Hebrides
Solomon Is.
Bismarck Archipelago
Admiralty Is.
Truk
Ponape
Kusaie
Nauru I.
Ocean I.
Tarawa
Funafuti
Rotuma I.
Norfolk I.
Lord Howe I.
Kermadec Is.
Auckland Is.
Campbell I.
Macquarie I.
Balleny Is.
Scott I.
Ross Sea
Ross Ice Shelf
Amundsen Sea
Thurston I.
Peter I. I.
Siple I.
Alexander I.
Weddell Sea
Antarctic Peninsula
Graham Land
Palmer Land
Ellsworth Land
Marie Byrd Land
Roosevelt I.
Hudson Mts.
Ellsworth Mts.
Pensacola Mts.
Thiel Mts.
Horlick Mts.
Shackleton Glacier
Beardmore Glacier
Transantarctic Mts.
Victoria Land
Ross Dependency
Adelie Coast
Wilkes Land
Queen Mary Coast
Enderby Land
Princess Martha Coast
Princess Ragnhild Coast
Queen Maud Land
Coats Land
Filchner Ice Shelf
Luitpold Coast
Caird Coast
Coats Land
Dronning Maud Land
Enderby Land
Kemp Land
Mac Robertson Land
Princess Elizabeth Land
Queen Mary Coast
Wilkes Land
Adelie Coast
Ross Dependency
Victoria Land
Transantarctic Mts.
Beardmore Glacier
Shackleton Glacier
Horlick Mts.
Thiel Mts.
Pensacola Mts.
Ellsworth Mts.
Hudson Mts.
Roosevelt I.
Marie Byrd Land
Ellsworth Land
Palmer Land
Graham Land
Antarctic Peninsula
Weddell Sea

FIGURE 10





HONOLULU – SEATTLE
(Makapuu Pt. – St. of Juan de Fuca)

APRIL 13-18, 1976

CALIFORNIAN

VOYAGE 269

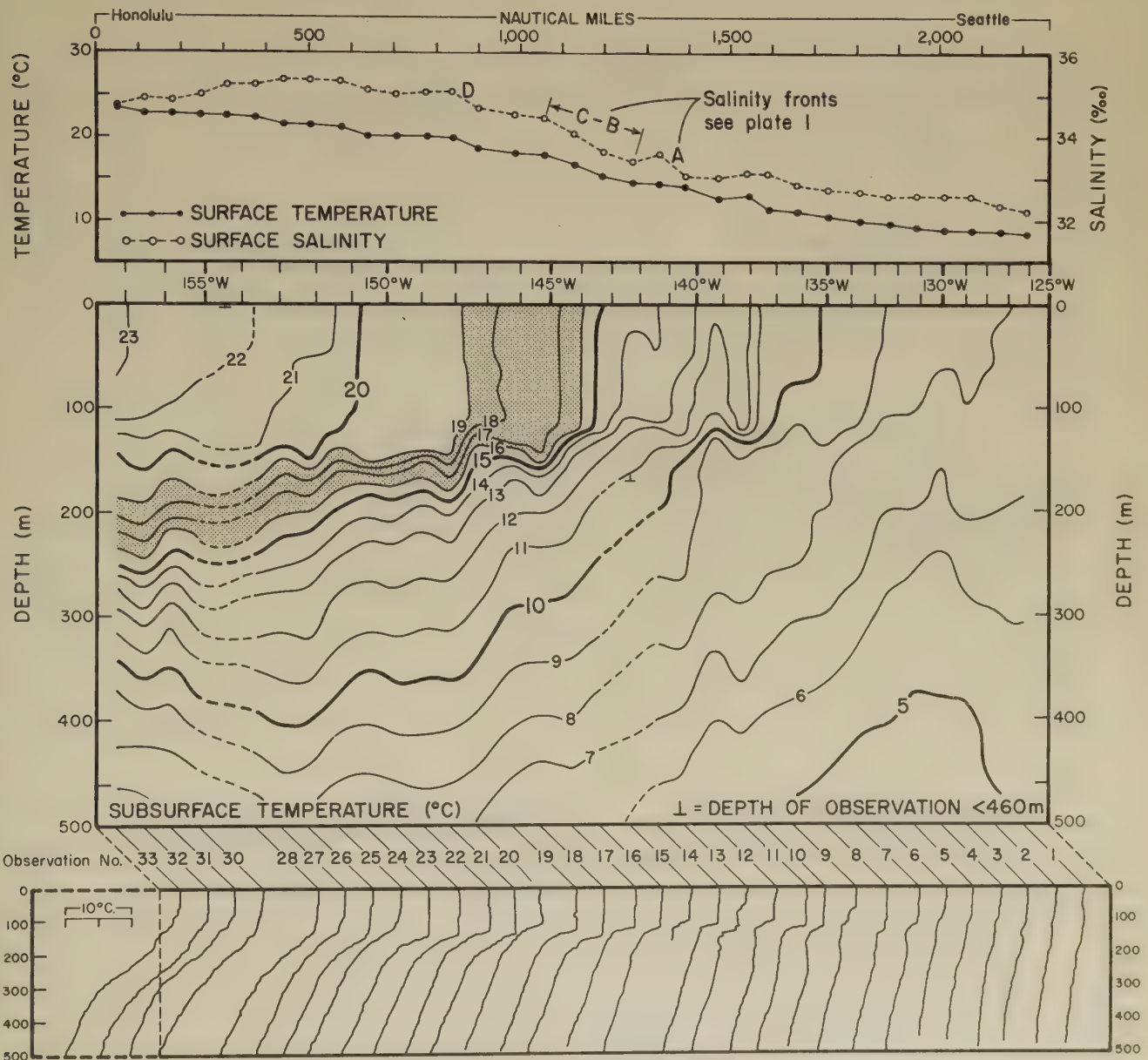
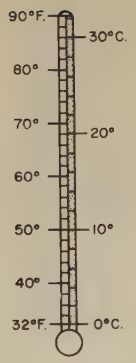


FIGURE 11



HONOLULU – SAN FRANCISCO

APRIL 1-7, 1976

HAWAIIAN QUEEN

VOYAGE 178

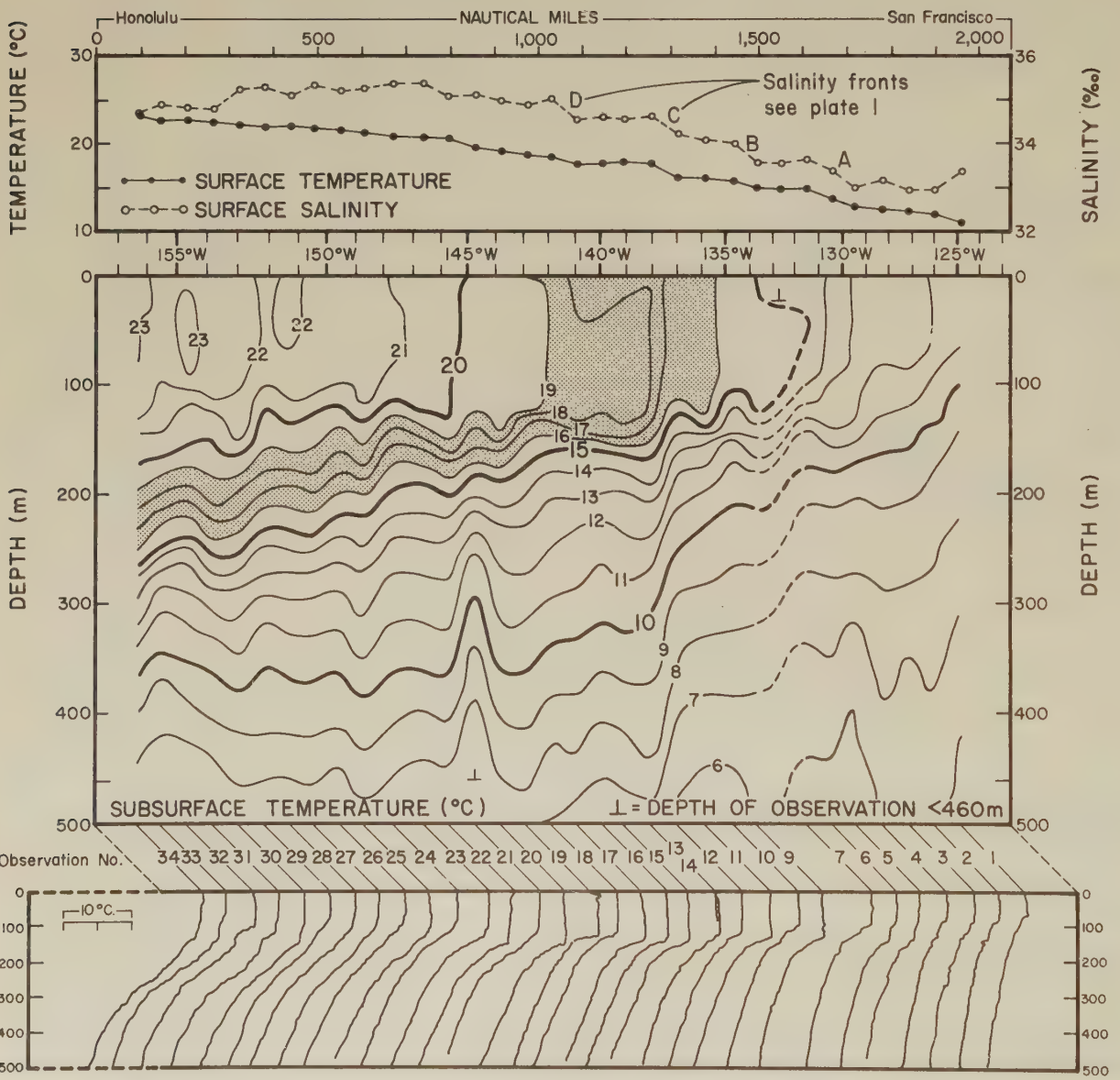
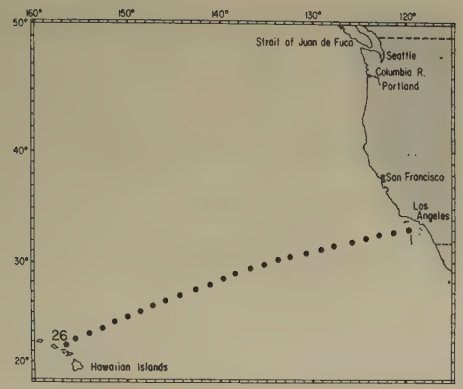
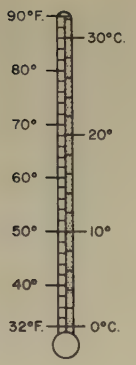


FIGURE 12





HONOLULU — LOS ANGELES

APRIL 3-7, 1976

HAWAIIAN ENTERPRISE

VOYAGE 138

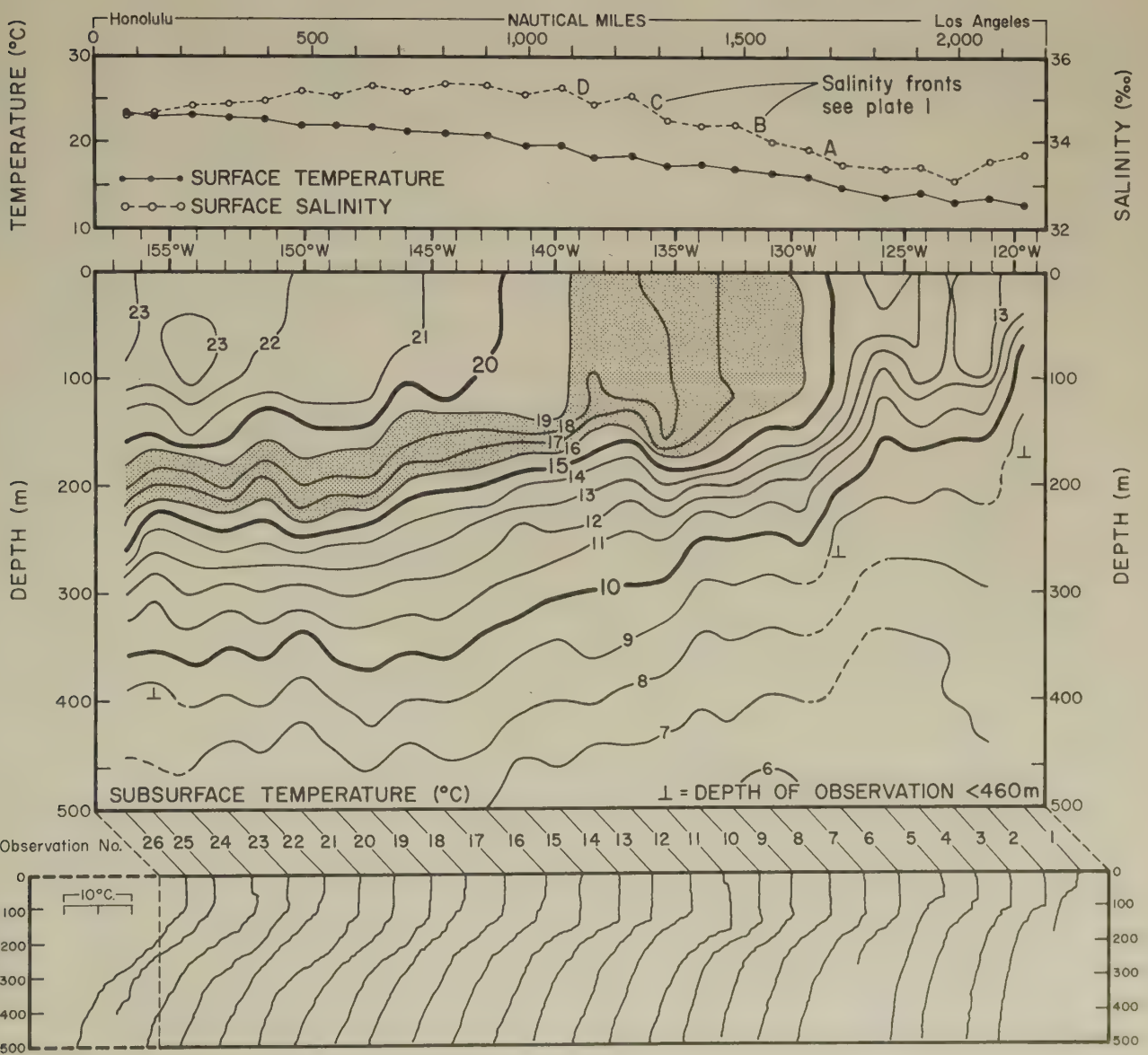
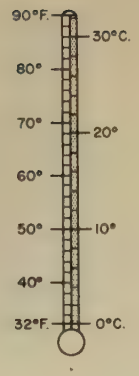


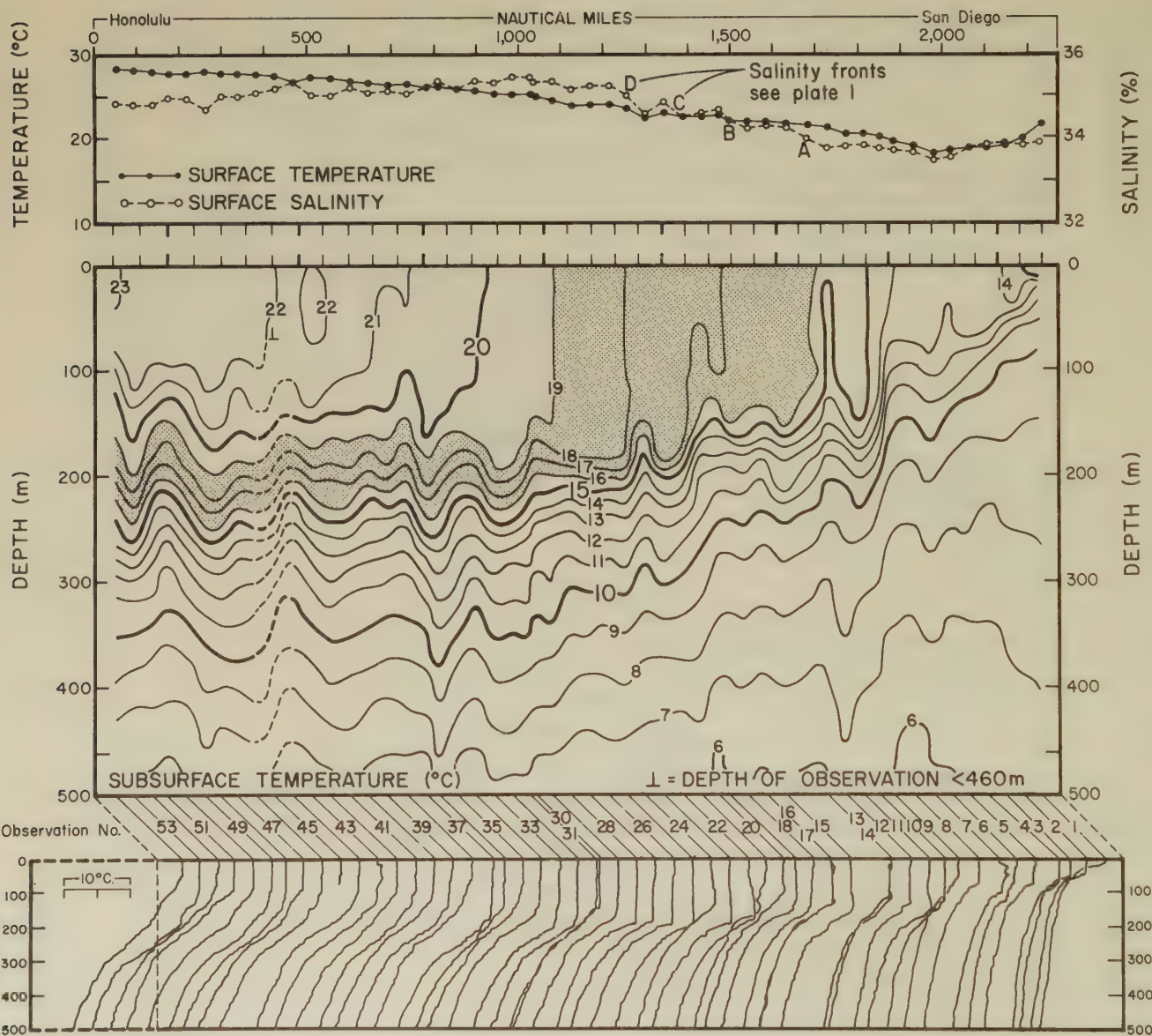
FIGURE 13



HONOLULU — SAN DIEGO

APRIL 3-11, 1976

TOWNSEND CROMWELL



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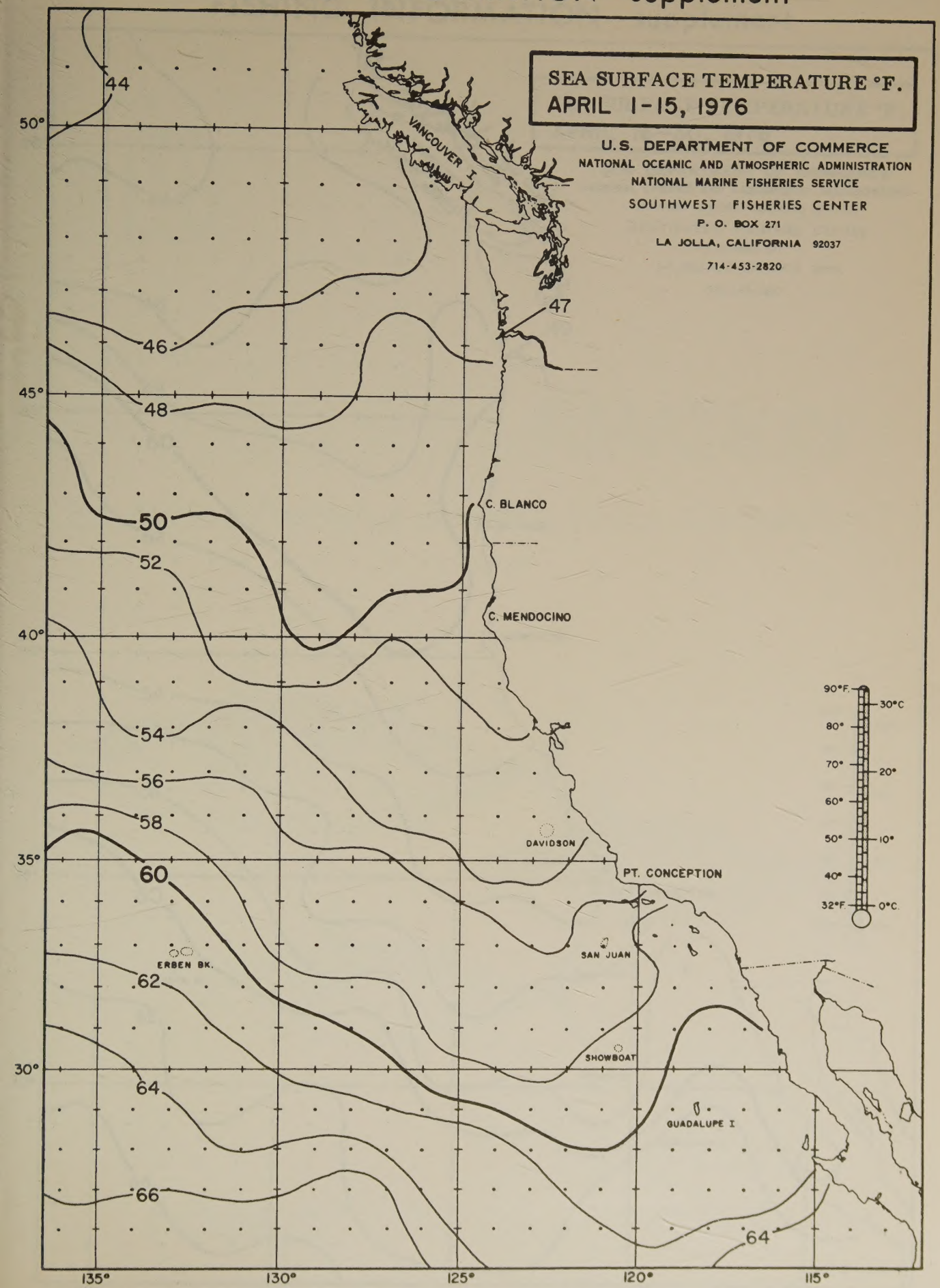

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